Article by Karl Dienstbach, undated

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THE NEW EPOCH IN AMERICAN AERONAUTICS. SECOND PART. By Karl Dienstbach.

One of the most remarkable appearances in American aeronautics of the present day is the Aerial Experiment Association. Formerly there has been given information in this journal about the so interesting and well subsidised labors of Dr. Alexander Graham Bell, his tetrahedral principle of construction for flying apparatus. During all the past years Dr. Bell has endeavored to turn one of his gigantic tetrahedral kites into a motor driven aeroplane. However, he found this task so difficult and complicated, especially as he wished to proceed systematically and to leave nothing to chance, that during the last year he was looking for assistance. His choice became two young engineers who had just graduated from the Toronto University in Canada, Messrs McCurdy and Baldwin. The former had been for long years a friend and almost a member of Dr. Bell's family—the house of his father was next to Dr. Bell's country place at Beinn Bhreagh, near the city of Baddeck in Nova Scotia, Canada, and Mr. Baldwin was introduced by him. Both are youthful, vigorous types of the Canadian Scotch as it has preserved itself surprisingly pure in the north of the New World. The real language of the country there is even Galic, an old Celtic. Dr. Bell, himself, is of Scotch descent. On his search for the right men as the constructors of his motor, Dr. Bell could finally hardly fail to become well acquainted with Glen 2 Hammond Curtiss. This latter, a son of the well-to-do old picturesque country town, Hammondsport, in the north of the State of New York, near Buffalo and Niagara Falls, at the beautiful Keuka Lake, of which the high shores, covered with vineyards and woods, with the substantial stone built wine cellars, remind one of the Rhine, had turned within a few years a small shop for bicycles into a thriving factory for motorcycles, in the three buildings of which about 90 workmen are employed. In its idealic seclusion, Hammondsport has just proved itself an especially fertile ground for aeronautical ideas,

and the light and strong Curtiss motor was early valued as a motive power for airships. Thus he drove the first California Arrow, Capt. T. Baldwin's creation, and soon was sought, not only by the latter's imitators, but also by many would-be inventors of dynamical flying apparatus. Curtiss is endowed with that happy practical insight, which let him find the simplest construction and the most servicable measurements; his motorcycles proved to be solid and speedy, and excel, especially in an original belt transmission which is also to be tried out in the newest flying machine; a built up leather belt is touching only both sides of a conical droove in the pulleys, and, therefore, a slip is not liable to occur even on small pulleys.—Dr. Bell, in the summer of last year had summoned Mr. Curtiss to Beinn Bhreagh, the scene of the newer tetrahedral experiments, and hardly the latter had made there the acquaintance of McCurdy and Baldwin, when Lieut. Selfridge arrived, a young officer of artillery who had made a special study of aeronautics, and had therefore been sent from Washington as an official observer of Dr. Bell's experiments. He was received with open arms.—Dr. Bell's gifted wife suggested then that all the above named should legally organize themselves into an “Aerial Experiment Association,” in return of which she would give a considerable 3 sum for the sole purpose to put any sort of dynamical flying machine , as fast as possible, into the air . Such good advice was immediately heeded, and in the beginning of winter the whole new “Association” followed Mr. Curtiss to Hammondsport where he was called back by his business.

Dr. Bell's family was included, and so the “capitol” of Hammondsport, yonder steep hill surmounting the whole village, which is crowned by Curtiss' house and the factory buildings, became a most unique stronghold of aeronautical enterprise. For long already the Mecca of more or less adventurous inventors, it now became an aim for the pilgrimage of more serious promoters of the art of flying, Augustus Post and Prof. Wood might be named as visitors for several days, and Herring and Manly belonged to the pilgrims' flock of the Aero Club of America which was drawn there by the flight for the prize of the Scientific American.

In Nova Scotia the Association had taken up Prof. Bell's own experiments. Lieut. Selfridge made there a long flight above water, aboard the gigantic tetrahedral kite “Cygnet,” that was towed by a steamer. Then it seemed to become apparent that the accumulation of so many thousand cells, which of course necessitated to place hundreds of them directly behind each other, marred the lifting effect. Whole masses of cells which seemed hardly within the reach of air current appeared to be solely useless ballast. (That experiment had ended with the destruction of the Cygnet, because the kite was sinking so imperceptibly that the towing line was neither cut in time aboard the steamer, from where the view was obstructed by the smoke from the funnel, nor by Lieut. Selfridge, who was not able to look directly beneath himself, and the cells were, therefore, dragged through the water at full speed. Selfridge escaped uninjured.)

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On the working program for the winter in Hammondsport, therefore, was placed also the search for a more advantageous grouping of the cells, also in favor of the younger element. Gliding experiments were suggested, which forthwith were taken up with enthusiasm. Faithful to the aim set by Mrs. Bell, viz., to arrive at real flight on the shortest route, there were soon rather eclectic proceedings, and thus a gliding machine was adopted, which came next to that of the brothers Voisin in France. In appearance it resembled the Herring-Chanute apparatus, but the most important part of that, the automatic steering tail, was replaced by a rigidly connected surface behind the wings, as wind vanes, small vertical planes at both sides behind the wing tips, were employed. The results of these gliding experiments resembled those of most of the epigons of the old able school. The obligation was missing to overcome the initial difficulties. And the light motor showed itself in too aluring a proximity. Lilienthal, Herring and the Wrights attained such enjoyable results, just because for the time being they were not at all able to see more than the gliding problem and were therefore given to the subject with heart and soul. It is rather an impediment for true progress, that gliding is more difficult in the beginning than dynamical flight, for the simple reason that it becomes so uninteresting and laborious in

a calm, that “flying in the wind” is simply a necessity. Nobody has as yet approached that degree of mastery which Lilienthal once acquired by an iron perseverance in practicing with his primitive apparatus. What would he say today at the almost superstitious fear with which Farman and Delagrange are trying to evade even the least breath of wind. He, who once judged Maxims' machine so severely only “because it could not fly even in a light wind!” It is worth while, by the way, to remark that Lilienthal's apparatus, exactly on account of their primitive 5 simplicity, were decidedly superior to the Farman type. That dihedral angle of the supporting surfaces and the large rear cell of the latter render indeed its flight in a calm unusually easy, but are such a hindrance in the wind, that with those machines it becomes altogether a riddle, how and when at last that art of flying in the wind without which a lightning fast flying machine has less practical utility than the smallest slow motor balloon will be learned! For Farman's machine this seems altogether impossible, because for instance the enormous leverage of the rear cell would paralyze the efforts of the front control to fight the wind gusts. Lilienthal's surfaces were simply neutral, without help and without hindrance, for the stability. His displacement of the center of gravity was indeed a too tiresome method of balancing, but nevertheless nobody has yet flown so boldly and so grandly in a strong wind, as just he, and the brothers Wright needed only to replace the shifting of heavy masses by the lightning fast movements of steering surfaces to turn the Lilienthal machine in principle into a far greater perfect flier, indeed, on the condition of a Lilienthal-like perseverance!

If the machine is thus based on the right principle, it should indeed be possible to acquire mastership without gliding by endlessly repeated short flights in winds of steadily increasing force, and so we may hope the best for the future of the Aerial Experiment Association in Hammondsport, because logical development of its eclectic method has led itfinally to the veritible Wright type! But let us return to that interesting development!

The above mentioned Hammondsport glider was smashed in the end at an awkward landing, in attempting to fly it as a kite, and was not again renewed. Instead, the “Red

Wings” was constructed (Dr. Bell has given pretty characteristic names to 6 all his apparatus—they indeed facilitate classification.)

This was really principally an imitation of Farman's then so triumphing machine. The difference only being that according to an idea of Mr. Baldwin, the upper surface, (across the direction of flight) was curved upwards, and the lower one downwards. Near the wing tips the mutually approaching surfaces had therefore to be made narrower in the direction of flight, and thus resulted a natural approach to the shape of a bird's wing, which was still accentuated by triangular wing tips. This form has been steadily preserved, and indeed justly, as it seems, for it prevents partly the disturbing lifting effect of a side gust, which at the worst it would turn into a sidewise shoving effect, which latter might just neutralize that one-sided lift because it might call for a certain lift on the opposite side in return.

Like Farman's, was a rear cell but of one surface with a vertical rudder, hinged on its top. But it was smaller in proportion and it was especially much lower than the principal cell. Peculiar was the wing profile, in the shape of Turnbulls S curve. (The curve reversed in the rear.)

It had been adopted eclectically in the interest of stability. This machine, mounted on sleigh runners, was tried on the ice of the frozen Keuka Lake. It was provided with that 40 horse power, air cooled, Curtiss motor which had been judged so favorably by experts at the second exposition of the Aero Club of America, and has been issultrated and described in the respective article of last year's issue of this journal. Indeed, the fear expressed at that time that air cooling would not be sufficient for full power was found to be only too well founded, with this accumulation of eight cylinders: In flight full power can be counted upon only for about three minutes. Taken over from the French was also the mounting of a small propeller directly on the motor shaft. 7 This machine unexpectedly flew up and away during a trial which was only to test its dirigibility on the ice. At a second successful flight, there being no method employed to control the lateral stability, the machine capsized, fell down sidewise on the ice and smashed. Officially, Lieut. Selfridge

had been its builder.—A second machine, the “White Wings,” succeeded it immediately, with the great innovation of the “wing tip control.” The twisting of the Wrights' wings was here imitated in principle, but two special horizontal rudders on the sides of every surface were substituted. Thus has the great advantage that there rudders in normal flight are set horizontally; while they thus did not participate in the flying angle of the supporting surfaces, in action the left rudders could be set positively at exactlythe same angle as the right ones negatively and vice versa; the mechanism always operated in this way, and thus there resulted no turning tendency from the righting tendency, like with the Wrights, which would have had to be compensated by the vertical rudder. In a clever way these safety surfaces were worked by the inclination of the upper body of the sitting operator. If the latter would incline, like Lilienthal, but with hardly the tenth part of the effort, towards the side which happened to be too high, he would set instantly these surfaces at the corresponding angles by means of a fork which surrounded his body, and the machine would at once right itself again. Like with Farman, the steering wheel for the vertical rudder was used at the same time to work the frontal horizontal rudder by being shoved fore and aft.—The White Wings were proveded with three wheels like those used for the Curtiss motorcycles. They could not set themselves automatically in the direction of flight (in relation to the ground) like those of Farman, and also did not have any springs. In turn, though, they were considerably lighter, and the center of gravity of the machine 8 could thus also be brought into greater proximity to the ground. The shortcomings mentioned have, however, never been felt so far, although the practicing grounds were rather unfavorable, fields and meadows, with trees on two sides and a railroad track with telegraph poles and wires on the opposite side, and half crossed by a very disturbing vineyard, in which an emergency landing would have been excluded. It was formed by the board valley which is the continuation of the elongated (and farther up forked) Keuka Lake —Hammondsport itself occupies its left side at the lake shore—and the practicing grounds are over three kilometers distant from the town. The necessary first run was taken on a rectangular race track with rounded corners, which 'though more resembled a German “fieldroad.” Therefore, it was found necessary to place a wheel under the framing of the

front control which would be moved by the steering wheel simultaneously with the vertical rudder, because the latter alone was not efficient in keeping the apparatus on the track during that preliminary run. It should yet be mentioned that the upright posts between the surfaces were sharpened after scientific rules and that all details of construction were of a very practical nature such as sheet steel connections for the wooden parts, etc.,—all these machines were unusually light for their size.—The “White Wings” were tried successfully several times by Selfridge and Curtiss, but came to grief at the first flight Mr. McCurdy ever took, because the latter leaned out of the fork of the tip control and thus finally could not prevent that the machine in the end would strike the ground sidewise with full force and be smashed to pieces. He escaped himself like through a wonder with a slight wound on the arm.—The “White Wings” had been officially the work of Baldwin and now came Mr. Curtiss' turn. His design was very similar, but the execution was more solid and deliberate. He left off, according to certain 9 experiences, the vertical surfaces of the rear cell. Thus he attained greater speed, and when now finally all of the cloth surfaces were also varnished, the lifting effect was considerable increased.—It has already been told, in a preceeding article by Moedebeck, how Mr. Curtiss won with this machine the beautiful silver trophy of the Scientific American on the Fourth of July, the national holiday of the declaration of independence, by a flight of one kilometer. It has made since yet many more and longer flights, and in the worst case has only been slightly damaged. During some repairs, though, it passed through a significant development. Yet during the prize flight the position of the center of gravity had not been correct, the horizontal rudder had to be depended upon to continually counteract the “bucking up” of the machine by a negative angle. On the day after the prize flight the first complete turn was at last successfully negotiated, but a second short turn would have had to follow it at once to clear that fatal vineyard, and for that too much speed had been lost during the first turn —thus the tip control would lose its effect, and the machine in its inclined turning position begun to glide down sidewise, and the right wing and also the front end were damaged. The latter was then lengthened and the seat for the pilot was shifted ahead for better balancing, so much that the motor could be placed at the same time a little further towards

the rear, to thus gain advantageous leverage of the inertia against tipping over. The frontal horizontal rudder was at the same time somewhat increased in size. Later, one of the only left horizontal tail surfaces was taken off with another resulting gain in speed and capacity for control, without any loss of stability. The surfaces were then varnished once more and —the machine by that, alas, lost its flying power.

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That unfortunate dispute about the question: “plane or curved surfaces” appears really very superfluous if one has seen how the bending straight of the too light ribs by the increased tension of the cloth resulting from the re-varnishing, had turned the curved surfaces into straight ones, and thus at once tied them to the earth. New ribs were then manufactured with a still more efficient single surve without that S curve, glued from four blades in place of three, and therefore better form preserving. Thanks to a favorable principle of construction, these ribs only needed to be inserted into pockets of the cloth from which the old ones had been removed, and the surfaces were again possessed of a most efficient curvature.

The motor was then provided with an extra lubricating apparatus, which allowed the cylinders to flood with oil and to keep them cool considerably londer and then at the first steering test with all these improvements, even the last horizontal surface was torn off the tail and—the machine would now fly more obediently then ever. It was then simply natural, to take off the useless empty frame of this rear cell altogether and to hold the vertical rudder directly by means of four bamboo poles while it was made shorter and higher at the same time. Finally it was completely in accordance with all the experiences of free motor flight that the power of the front controls should be increased. It was therefore made of two big super-posed surfaces and at the same time shifted farther towards the front. By all that the machine for the trained operator did in no way lose in stability, but it became only much more obedient, and so it happened, that finally, on the 29th day of August, Mr. McCurdy was able to describe over this unfavorable ground a closed figure eight, more than three kilometers, in three minutes, and at a height of some eight meters. He landed

at the starting point in the middle of this figure. There was a 11 light wind. At the last practicing flights, heights of 20 meters and more had already often been reached. Thanks to the tip control and the narrow wing tips, much shorter turns may be made than they are possible for the Farman type, for which latter the practicing grounds in Hammondsport would probably be altogether useless.—A new improved machine has now also been almost completed. This was named “Silver Dart,” because its surfaces are covered with Capt. Baldwin's new silver grey rubber, impregnated silk which weighs much less and is absolutely air tight. The wings are somewhat narrower and over two meters longer. By their slender curve they thus resemble much the wings of a gigantic albatross. Of course, two passengers are here counted upon. The construction is extremely elegant. Skill and experience gained were put to use. Of course the rear cell is now completely absent, and the rudders have become as powerful as possible, both big surfaces and both mounted at the end of long lever arms. Practically this is a “Wright machine,” only with several good original features. A water cooled motor with radiator of 50 horse power is under construction for that machine, which, with all accessories and the passengers, is to be placed into a fish shaped central body. The surface of the four triangular tip controls has likewise been increased. Trial flights will soon take place. Officially, this is Mr. McCurdy's machine, and that with so much the more right, as only Curtiss could yet help; because Selfridge had been recalled to service at Washington, for the tests of the government air craft, and Dr. Bell, with Mr. Baldwin, had again eluded the summer heat in Nova Scotia. There good work has also been done. Numberless scientific ascensions of tetrahedral kites led finally to a shape which was adopted for a giant tetrahedral flying machine, which is now at last under construction. The design is very different from “Cygnet,” for between the groups of cells empty spaces have been left to allow free access to the air currents 12 everywhere. On account of the great natural stability of tetrahedral flying apparatus, there is only an horizontal rudder in front and a vertical rudder behind the propeller, needed. This flying machine is intended to be towed by a steamer as a kite, and motor and propeller will become operative only after it is in the air.

N.B. At the request of the Secretary, this article was translated from the German by Mr. Dienstbach, so it could be incorporated into the records of the Association.

J.A.D. McCurdy.